

REMARKS

Claims 1 through 53 are pending in the present application. Claims 1 through 53 stand rejected. Claims 1, 12, 17 through 20, 22, 30, 34, 42, 43, 48 through 50 and 53 have been amended herein. Reconsideration is respectfully requested in light of the present amendments and following remarks. The above amendments and following remarks are believed to be fully responsive to the outstanding Office Action and to render all claims at issue patentably distinct over the references cited.

The Examiner has rejected claims 1, 2, 4 through 7, 9, 12, 13, 15 through 26, 29, 33, 43, 44, 50 and 53 under 35 U.S.C. §102(b) as being anticipated by Speller, Jr. et al. (U.S. Patent No. 5,829,115). This rejection is respectfully traversed. It is believed that the originally filed claims are patentably distinct over the cited reference. It is also noteworthy that Speller, Jr. et al. ('115) is not prior art to the present application under 35 U.S.C. § 102(b) as improperly asserted by the Examiner; thus, if another Office Action is forthcoming, it should not be made final.

Notwithstanding, the independent claim 1 has been amended to state that the riveting characteristic consists essentially of at least one of: riveting force, riveting punch assembly location, rivet size, or workpiece thickness. Support for this amendment can be found within at least the following paragraph numbers in the originally filed application: [0049], [0051], [0052], [0054], and [0060]. In contrast, Speller, Jr. et al. ('115) only employs a position feedback sensor 510 to determine a velocity of an armature shaft of the actuator motor in order to solely adjust the motor output shaft position relative to the intended position. Only one sensor is employed and it does not detect an actual riveting characteristic such as those claimed.

The independent claim 12 has been amended at item (e) to state that the sensor operably senses riveting force. As previously noted, the claimed combination of elements, especially the “riveting force” sensing, is not disclosed in the cited reference.

The independent claim 22 has been amended at items (e) and new (f) to state that a self piercing riveting is operably driven by the punch as controlled by the electrical control unit and a die operably diverges an end of the rivet without the rivet piercing completely through the exterior surface of a die-side workpiece adjacent the die. Support for this amendment can be found within Applicants’ originally filed specification at least in paragraph numbers [0052]-[0054]. In contrast, the cited reference does not teach the use of such a self piercing rivet or the die interaction with same. The machinery and processes associated with self piercing and die-side hidden rivets can be quite different than more traditional frangible stem-type blind rivets or predrilled rivets; it is noteworthy that this argument does not apply to claims not limited to such self piercing rivets.

The independent claim 43 has been amended at item (c) to state that the rivet is of a hollow and diverging type with a solid head. Support for this amendment can be found within Applicants’ originally filed figures 8 and 13, as well as Applicants’ originally filed paragraph numbers [0006], [0011], [0053] and [0055]. The cited reference does not disclose this claimed combination of elements, especially as amended, as described above.

The independent claim 50 has been amended at item (e) to state that the electrical control unit operably determines if a “riveted joint” is within a desired range. In

contrast, the cited reference does not teach sensing and any “determining” action based on an actual riveted joint but instead merely senses the electric motor armature position without any correlation to the riveted joint. Accordingly, it is respectfully requested that the instant rejection be withdrawn.

Claims 3, 8, 10, 11, 14, 27, 28, 30 through 32, 34 through 42, 45 through 49, 51 and 52 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Speller, Jr. et al. ('115) in view of Gast (U.S. Patent No. 4,901,431). This rejection is respectfully traversed. It is believed that the originally filed claims are patentably distinct over the cited references. Furthermore, there is no suggestion or motivation to combine the cited references especially since significant reengineering of the entire devices would be required to effect their combination. It appears that the Examiner is improperly using hindsight reasoning given the benefit of the present invention as a template.

Notwithstanding, the independent claim 34 has been amended at item (c) to state that a self piercing rivet is operably set by the punch acting with a generally relatively stationary die. Support for this amendment can be found within Applicants' originally filed figures 9, 12 and 13, as well as the accompanying specification. In contrast, the cited references do not teach, suggest or motivate use of a self piercing rivet, let alone one that has a predominantly stationary die. For example, Speller, Jr. et al. ('115) discloses use of “either or both of the upper and lower riveting rams” in column 11 at line 13, and Gast employs a predrilled, breakable stem 62 on the fastener 13 (see column 5, lines 46 through 50). These differences are significant from the presently claimed invention.

The independent claim 48 has been amended at item (d) to state that a sensor is operable to indicate a "riveting force" characteristic. As previously discussed, the cited references do not teach, suggest or motivate sensing of the actual riveting force. This difference is significant in insuring that a quality joint has actually been created. based on actual rivet, workpiece and/or joint force or dimensional measurements.

The Examiner's assumptions with regard to claims 10 and 11, 27 and 28, 30 and 34, and 47 are hereby respectfully challenged as lacking support and being incorrect in light of the presently claimed combination of elements. For example, the die-side construction of the riveting machine is very important to insuring the proper divergence, and even more preferably the hidden open-end, of a self piercing rivet; no such arrangement is provided or suggested by Speller, Jr. et al. ('115) and Speller actually teaches away from such by its disclosure in column 11, lines 6 through 13, and the additional machining tools disclosed in figures 9 and 10. Accordingly, it is respectfully requested that the instant rejection be withdrawn.

In view of the instant amendments, it is submitted that the present application is in condition for allowance. Accordingly, it is requested that the Examiner pass the case to issue at his earliest convenience.

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HARNESS, DICKEY & PIERCE, P.L.C.
P.O. Box 828
Bloomfield Hills, Michigan 48303
(248) 641-1600

Respectfully submitted,

By: 

Monte L. Falcoff
Reg. No. 37,617

ATTACHMENT FOR CLAIM AMENDMENTS



The following is a marked up version of each amended claim in which underlines indicates insertions and brackets indicate deletions.

1. (Amended) An electronic control system for use in a riveting process, the system comprising:

an electronic control unit;

an electric motor connected to the electronic control unit;

a first sensor connected to the electronic control unit and the electric motor, the first sensor being operable to indicate at least one of: (a) torque of the electric motor, (b) speed of the electric motor, and (c) an electrical power characteristic of the electric motor; and

a second sensor connected to the electronic control unit, the second sensor operably detecting a riveting characteristic occurring during the riveting process, the riveting characteristic consisting essentially of at least one of: (a) riveting force, (b) rivet punch assembly location, (c) rivet size, and (d) workpiece thickness.

12. (Amended) A riveting electrical control system comprising:

(a) an electrical control unit;

(b) an electric motor connected to the electrical control unit;

(c) a transmission operably driven by energization of the electric motor;

(d) a riveting punch operably advanced by the transmission; and

(e) a sensor connected to the electrical control unit, the sensor being operable to sense riveting force [a characteristic of the electric motor].

17. (Amended) The system of Claim 18 [12] wherein the characteristic changes at least in part due to varying rivet setting performance.

18. (Amended) The system of Claim 12 further comprising a second [wherein the] sensor operably sensing [senses] an electrical power characteristic of the electric motor.

19. (Amended) The system of Claim 12 further comprising a second [wherein the] sensor operably sensing [senses] a speed of the electric motor.

20. (Amended) The system of Claim 12 further comprising a second [wherein the] sensor operably sensing [senses] a torque of the electric motor.

22. (Amended) A riveting electrical control system comprising:

- (a) an electrical control unit;
- (b) an electric motor connected to the electrical control unit;
- (c) a transmission operably driven by energization of the electric motor, the transmission operably converting rotational movement of the electric motor to substantially linear movement;

(d) a riveting punch operably advanced in a substantially linear direction by the transmission; [and]

(e) a self-piercing rivet operably driven [driving] by the punch as controlled by the electrical control unit; and

(f) a die operably diverging an end of the rivet without the rivet piercing completely through the exterior surface of a die-side workpiece adjacent the die;

the electric control unit operably controlling energization of the electric motor and operably determining if an undesired riveting condition is present.

30. (Amended) The system of Claim 22 wherein the electronic control unit automatically operably causes varying sized [the rivet is a] self piercing rivets to be [rivet] operably driven by the punch.

34. (Amended) A control system comprising:

(a) a programmable control unit;

(b) a riveting machine including an electric motor and a transmission operable to convert rotary motion of the electric motor to linear motion of a punch;

(c) a self piercing rivet operably set by the punch acting with a substantially relatively stationary die of the riveting machine when the control unit causes energization of the electric motor; and

(d) a feeder operable to transfer the rivet to the riveting machine.

42. (Amended) The system of Claim 34 wherein the electrical control unit determines if a riveting characteristic is within a desired range, the rivet being of a hollow and diverging type with a solid head.

43. (Amended) A control system comprising:

- (a) a programmable controller;
- (b) a riveting machine including an electric motor and a transmission, the transmission being operable to convert rotary motion of the electric motor to substantially linear motion;
- (c) a rivet operably moved by the riveting machine when the controller causes energization of the electric motor, the rivet being of a hollow and diverging type with a solid head; and
- (d) a sensor operable to indicate power consumption of the electric motor, the controller operably receiving a signal generated by the sensor.

48. (Amended) A control system comprising:

- (a) a programmable controller;
- (b) a riveting machine including an electric motor and a transmission, the transmission being operable to convert rotary motion of the electric motor to linear motion, a section of the electric motor being rotatable about an axis offset from a centerline coaxial with an elongated dimension of the punch;
- (c) a rivet operably moved by the riveting machine when the controller causes energization of the electric motor;

(d) a sensor operable to indicate a riveting force [an electrical] characteristic [of the electric motor], the controller operably receiving a signal generated by the sensor;

(e) an articulating robot, the riveting machine being attached to and positioned by the robot; and

(f) a rivet feeder connected to the riveting machine, the controller operably controlling actuation of the rivet feeder.

49. (Amended) The system of Claim 48 wherein the controller compares the signal generated by the sensor to previously stored data, and the rivet having a solid head and a diverging open end which does not completely penetrate a workpiece farthest from the head.

50. (Amended) A riveting electrical control system comprising:

(a) an electrical control unit;

(b) an electric motor connected to the electrical control unit;

(c) a mechanical transmission operably converting rotational movement of the electric motor to substantially linear movement; and

(d) a rivet setting punch operably advanced by the transmission;

(e) the electrical control unit operably determining if a riveted joint [rivet setting characteristic] is within a desired range.

53. (Amended) The system of Claim 50 wherein the electrical control unit includes a programmable microprocessor which compares sensed data to other data, and the electrical control unit continuously compares actual workpiece thickness signals to previously stored workpiece thickness signals substantially during rivet setting.